

**A METHOD AND SYSTEM FOR MAKING AN OPEN SYSTEM VOLUME
ACCESSIBLE TO AN MVS SYSTEM**

5 FIELD OF THE INVENTION

The present invention relates to an enterprise storage system and, more particularly, to an enterprise storage system in which a computer that processes data
10 formatted in a first format is enabled to read data formatted in a second format from a storage subsystem that is capable of storing data in either the first format or the second format.

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BACKGROUND OF THE INVENTION

Many organizations store information in an enterprise storage system that includes some components
20 that utilize an open system architecture and other components that utilize a multiple virtual storage (MVS) system architecture. An organization having such a system must be able to move information between components of the two different architectures.

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U.S. Patent No. 5,640,541 to Bartram et al.,
entitled "Adapter For Interfacing A SCSI Bus With An IBM
System/360/370 I/O Interface Channel And Information
System Including Same", describes an adapter for
30 interfacing two different architectures. The adapter is coupled to, and allows bi-directional communication

between, a Small Computer Standard Interface (SCSI) bus and a System/360/370 I/O Interface Channel.

However, an enterprise storage system can include a
5 data storage subsystem capable of interfacing with both
an open system processor and an MVS processor. Such a
data storage subsystem permits the open system processor
to write and read data in an open system format, and it
permits the MVS processor to write and read data in an
10 MVS format..

A system that includes a data storage subsystem
capable of interfacing with both an open system
processor and an MVS processor would benefit from an
15 arrangement where the MVS processor is enabled to read
data that is stored in the data storage subsystem in the
open system format. An organization could thereby apply
MVS procedures to backup and restore the open system
data, and thus consolidate the backup of open system
20 data volumes into existing backup processes for MVS data
volumes.

Accordingly, it is an object of the present
invention to provide a system in which an MVS processor
25 can read open system data from a data storage device.

It is another object of the present invention to
provide such a system in which the open system data is
backed up through the MVS processor in accordance with
30 an MVS backup procedure.

SUMMARY OF THE INVENTION

In accordance with the present invention, a method
5 is provided for enabling a computer that processes data
formatted in a first format to read a data unit that is
formatted in a second format from a storage subsystem
that is capable of storing data in either the first
format or the second format. The method comprises the
10 steps of dispatching, from the computer to the storage
subsystem, a command for the storage subsystem to
report a data length of the data unit; sending, from
the storage subsystem to the computer, a value of the
data length that enables the computer to determine
15 whether the data unit is in the first format or in the
second format and prepare for receipt of the data unit,
in the first format or the second format, having the
indicated data length; dispatching, from the computer
to the storage subsystem, a command for the storage
20 subsystem to forward the data unit to the computer; and
sending the data unit from the storage subsystem to the
computer.

In accordance with one embodiment of the present
25 invention, a system is provided in which a computer
that processes data formatted in a first format is
enabled to read data formatted in a second format from
a storage subsystem that is capable of storing data in
either the first format or the second format. The
30 computer dispatches a command for the storage subsystem
to report a data length of the data unit; determines

whether the data unit is in the first format or the second format and prepares for receipt of the data unit, in the first format or the second format, based on the data length; and dispatches a command for the storage subsystem to forward the data unit to the computer. The storage subsystem sends a value of the data length to the computer and sends the data unit to the computer.

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BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a block diagram of an enterprise storage network particularly suited for employment of the present invention; and

Fig. 2 is a flowchart of a method for causing a data unit that is formatted in a SCSI format to take a CKD format in accordance with the present invention.

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DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 is a block diagram of an enterprise storage network 5 particularly suited for employment of the present invention. Network 5 is a system in which a computer that processes data formatted in a first format is enabled to read data formatted in a second format from a storage subsystem that is capable of storing data in either the first format or the second format. For the purpose of illustration herein, the

first format is CKD and the second format is SCSI. The system includes an open system processor 10, an MVS processor 15, a data storage subsystem 30 and a backup subsystem 20.

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Open system processor 10 is coupled to data storage subsystem 30 via a bus 12, and MVS processor 15 is coupled to data subsystem 30 via a bus 22. Backup subsystem 20 is coupled to MVS processor 15 via a bus 17.

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Open system processor 10 can be any computer workstation or personal computer, including but not limited to a UNIX®-based, DOS or Windows™ system, that communicates with other components according to the Small Computer Standard Interface (SCSI) standard. As an example, a Solaris™ workstation, available from Sun Microsystems, Inc. of Palo Alto, California can serve in this capacity.

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Data stored in accordance with the SCSI standard is organized into fixed-size blocks, and a predetermined number of blocks are organized into a logical unit (LUN). In an open system, one read or write command can transfer a complete LUN of data between a processor and a data storage device.

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MVS processor 15, typically a mainframe computer such as a System 390 available from IBM Corporation of Armonk, New York, communicates with other components in accordance with the Enterprise System Connection (ESCON)

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protocol. It includes an associated memory 15a for storing data and program instructions. When transferring data from or to a storage device, MVS processor 15 requires data to be organized in the Count, Key and Data (CKD) format.

Data stored in accordance with the CKD format is organized into records that are located in tracks. A predetermined number of tracks are further organized into an MVS logical device. A CKD track has a variable usable data length, and it commences with a header, which includes a home address field, a record 0 field, and a count field that indicates the usable data length.

Data storage subsystem 30 is a data storage device, such as a Ramac Scalable Array-3 (RSA-3) available from IBM Corporation, Armonk, NY, that is capable of storing data in the SCSI format and also capable of storing data in the CKD format. Data storage subsystem 30 includes a SCSI host director (SHD) 35, with which it exchanges SCSI formatted data with open system processor 10, and an ESCON host director (EHD) 25, with which it exchanges CKD formatted data with MVS processor 15.

Backup subsystem 20 is a conventional storage subsystem, typically a disk or tape system, used for backing up data. MVS processor 15 executes an MVS backup procedure in which it copies data from data storage subsystem 30 and writes the data to backup subsystem 20.

Within data storage subsystem 30, both SCSI data and MVS data is organized into MVS logical devices. Each MVS logical device has a Volume Label (VOLID) and a Volume Table of Contents (VTOC) in accordance with an
 5 MVS storage protocol. The VOLID resides at a logical cylinder 0, head 0 of data storage subsystem 30, and the VTOC resides at cylinder 0, heads 1 -14.

When data storage subsystem 30 stores a SCSI LUN
 10 from open system processor 10, SHD 35 maps the SCSI LUN on top of one or more MVS logical devices. In order for the mapped data to conform to the MVS storage protocol, SHD 35 bypasses cylinder 0 when writing SCSI data to data storage subsystem 30. More particularly, when SHD
 15 35 maps a SCSI block to an MVS track, SHD 35 starts writing SCSI block 0 to MVS cylinder 1, head 0, and then progresses to subsequent tracks on the logical device.

SCSI data does not include a home address field, a
 20 record 0 field, and a count field as required by the CKD format. Accordingly, when SCSI data is written to a track within data storage subsystem 30, the quantity of usable data written to the track is greater than that which can be written under the CKD standard. That is,
 25 the usable data length of a track containing SCSI data is greater than the usable data length of the track if it contained CKD data.

When MVS processor 15 wishes to read a data unit,
 30 e.g., a track of data, from a logical device within data storage subsystem 30, MVS processor 15 first determines

whether the logical device is a normal MVS logical device or whether it is assigned as part of a SCSI LUN. MVS processor 15 distinguishes between an MVS logical device and a SCSI LUN based on the usable data length of the track of data.

MVS processor 15 dispatches a Read Device Characteristic Command, which is a command for data storage subsystem 30 to report an identifier of a family of storage subsystems of which data storage subsystem 30 is a member, and the usable data length of the track. In response, data storage subsystem 30 sends to MVS processor 15 the family identifier and a value of the usable data length. This information enables MVS processor 15 to determine whether the track contains CKD data or SCSI data. MVS processor 15 expects a particular maximum usable data length for a particular family of storage subsystem. If the usable data length is less than or equal to the maximum expected value, then MVS processor 15 concludes that the track contains CKD data. If the usable data length is greater than the maximum expected value, then MVS processor 15 concludes that the track contains SCSI data.

Accordingly, based on the value of the usable data length, MVS processor 15 determines whether the data unit is in CKD format or SCSI format, and prepares to receive the track, in CKD format or SCSI format, having the indicated usable data length. For example, MVS processor 15 may allocate a buffer to accommodate the track based on the usable data length.

Subsequently, MVS processor 15 dispatches a command for data storage subsystem 30 to forward the track of data to MVS processor 15. Data storage subsystem 30 responds by sending the track to MVS processor 15. EHD 25 distinguishes a track of SCSI data from a track of CKD data based on the usable data length of the track, as described above. If the track contains SCSI data, then EHD 25 appends a header to the track to enable MVS processor 15 to process the track. The header includes a home address, a record 0, and a count field in accordance with MVS protocol. MVS processor 15 receives the track, in either the first format or the second format, having the usable data length reported by storage subsystem 30.

Fig. 2 is a flowchart of a method for enabling a computer that processes data formatted in a first format to read a data unit that is formatted in a second format from a storage subsystem that is capable of storing data in either the first format or the second format in accordance with the present invention. This method is implemented in a system such as that shown in Fig. 1 and described above. For the purpose of illustration herein, the first format is CKD and the second format is SCSI. While the procedures required to execute the invention hereof are indicated as already loaded into MVS processor 15 and data storage subsystem 30, respectively, they may be configured on a storage media, such as data memory 13 in Fig. 1, for subsequent loading into these components.

MVS processor 15 wishes to read a track of data from data storage subsystem 30. The method begins with step 110.

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In step 110, MVS processor 15 dispatches a Read Device Characteristic Command to data storage subsystem 30. Data storage subsystem 30 responds by sending a report that includes a usable data length of the track.
10 The method then advances to step 115.

In step 115, based on the usable data length, both MVS processor 15 and data storage subsystem 30 determine whether the track contains SCSI data or CKD data. If
15 the track contains CKD data, then the method branches to step 125. If the track contains SCSI data then the method advances to step 120.

In step 120, MVS processor 15 prepares to receive
20 the track, in either CKD format or SCSI format, having the usable data length reported by storage subsystem 30 in step 110. Also, storage subsystem 30, via EHD 25, appends a header to the track. The header includes a home address, a record 0, and a count field in
25 accordance with MVS protocol. The method then advances to step 125.

In step 125, MVS processor 15 dispatches a command for data storage subsystem 30 to forward the track. In
30 response, data storage subsystem 30 sends the track of data to MVS processor 15. MVS processor 15 receives the

track, in either CKD format or SCSI format, having the usable data length reported by storage subsystem 30 in step 110. The method then advances to step 130.

5 In step 130, the method ends.

 It should be understood that the foregoing description is only illustrative of the invention. Various alternatives and modifications can be devised by those skilled in the art without departing from the invention. For example, the present invention is not limited to an open system and an MVS system, or to SCSI and CKD data formats, but can be applied in any case where the data formats can be distinguished on a basis of usable data length. Accordingly, the present invention is intended to embrace all such alternatives, modifications and variances that fall within the scope of the appended claims.